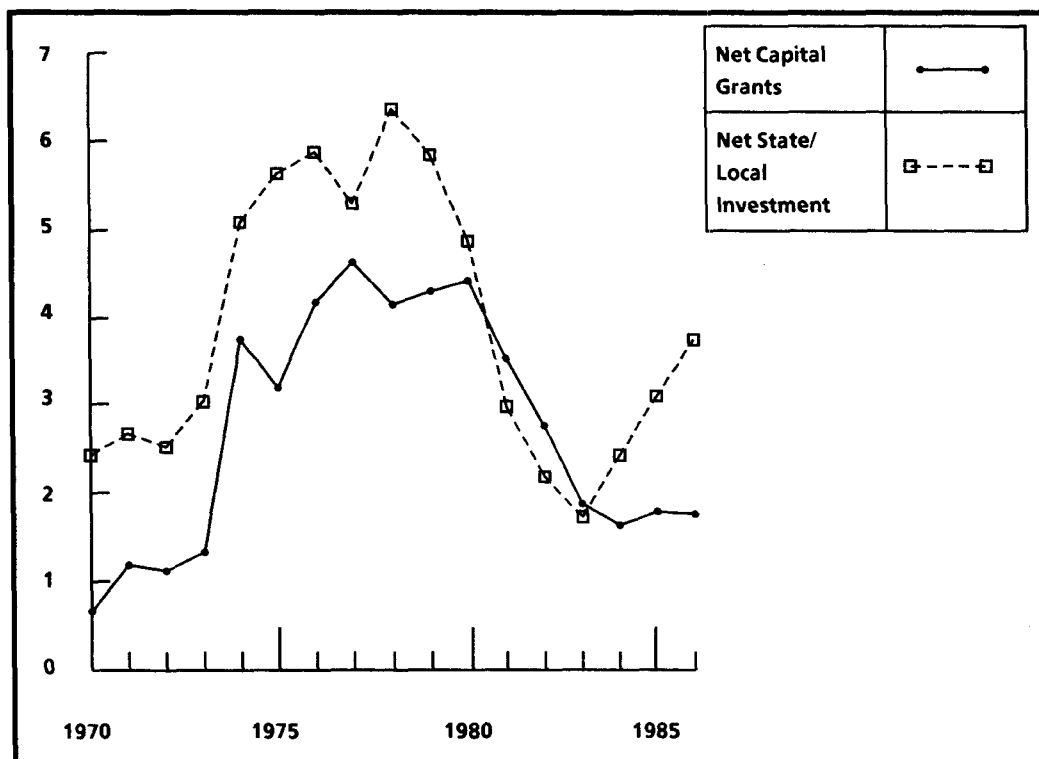


FIGURE 8. INVESTMENT IN WASTEWATER TREATMENT
(In billions of dollars at 1982 prices)



SOURCE: Congressional Budget Office, based on data from the Bureau of Economic Analysis.

NOTE: Net investment is based on deducting equal annual amounts for depreciation.

First, independent studies and those of the Environmental Protection Agency report that the increased federal funding that followed the 1972 Clean Water Act replaced state and local funding rather than raising national investment in wastewater treatment. During the 1970s, state and local government spending fell to little more than that needed to match federal construction grants. Overall state and local government spending from their own resources fell by 80 percent between 1972 and 1976, while federal spending quintupled to 90 percent of national construction outlays. By 1982, independent construction was less than \$1 billion (at 1982 prices) compared with \$2.3 billion in 1970.^{6/}

6. See James Jondrow and Robert A. Levy, "The Displacement of Local Spending for Pollution Control by Federal Construction Grants," *American Economic Review*, vol. 74, no. 2 (May 1984), and Environmental Protection Agency, *Study of The Future Federal Role in Municipal Wastewater Treatment*, Report to the Administrator (December 1984).

Second, the 1978 Clean Water Act extended the 1983 national target for clean water to 1988. This, together with rising interest rates for municipal borrowing beginning in 1980, may have eased pressure to maintain a high rate of investment, and probably induced some localities to defer investment plans. Third, during the same period, management of the clean water assistance programs was gradually transferred from the Environmental Protection Agency to the states, and 40 states have accepted full delegation since 1977. Under state management, priority lists for construction were revised, which may have delayed new starts.

Finally, the 1978 act provided incentives for using innovative technologies so that project sponsors were encouraged to use less costly treatment systems if those systems would meet clean water standards. Use of innovative treatment methods may have permanently lowered (by an unknown amount) the investment cost needed to achieve overall clean water standards. Any such lowering, however, would contribute to a long-term decline in the costs of meeting clean water goals, rather than to a sudden falloff in spending.

The resumption in nonfederal net investment evident from 1983 has driven the federal share in national investment below the 55 percent match for federally aided projects under current law: the 1986 federal grant share of net additions to wastewater treatment plants was 47 percent. The relationship of these two percentages implies about the same share of non-aided construction as during the 1970s, when the grant program offered 75 percent of construction costs and the federal share was 64 percent.

Transit

Analysis of the third grant program contributing to cities' infrastructure--transit aid--suggests that cities have been unable to use all the aid provided to them. Net investment and net grant assistance for transit systems have risen fairly steadily (apart from a sharp drop in 1978, probably reflecting New York's financial crisis) and at much the same pace between 1970 and 1981. Since then, however, the paths have diverged: overall net investment has continued to rise to just under \$3 billion a year in 1985, while net grant aid for investment has fallen to around \$700 million a year. But the falloff in net investment

from grants results not from reduced program support but from a much reduced spending of appropriated resources.

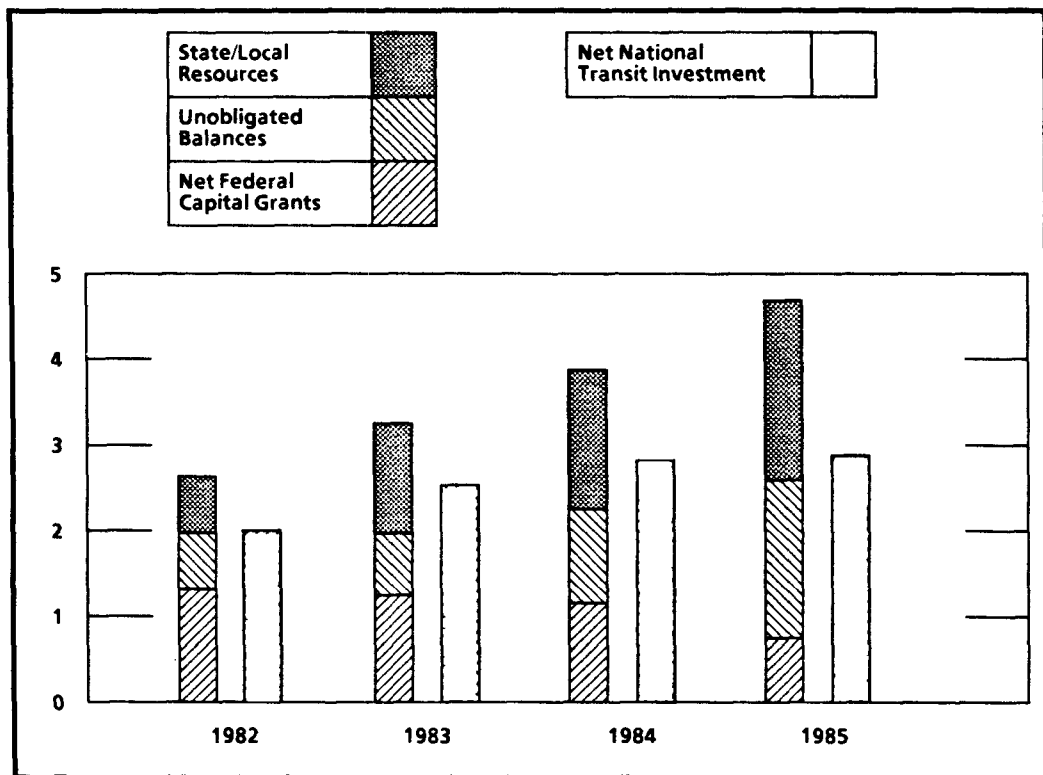
Since 1982, unobligated balances--the differences between amounts appropriated by the Congress and those obligated for spending by recipients--have been growing sharply. By 1985 transit agencies nationwide had \$1.8 billion (in 1982 prices) available that they had not committed to projects--well above the amount that would reflect the ordinary delay between authorization of spending and letting of contracts for supply or construction. About \$1 billion of the unobligated funds were resources under the formula program that allocates aid to all cities according to population and density criteria. The remainder was largely in the discretionary program that finances named projects in different cities, particularly for rail modernization and new transit systems. The balance in the account for funding for the Washington area Metro system was \$200 million, because of construction delays.

According to a study by the General Accounting Office, \$707 million of the \$994 million in unobligated balances at the end of 1985 under the Urban Mass Transportation Administration's formula grant program (which the 1982 Surface Transportation Assistance Act effectively converted from operating to capital aid) has been allocated to cities of one million inhabitants or less that have not applied for assistance.^{7/} For many of these cities, modernization of their bus service was completed under the earlier program. The gap in spending of discretionary resources arises from the Administration's "no new starts" policy that has delayed new construction on new (mostly rail) transit systems in seven cities. From 1982 to 1985, states' and localities' overall investment in transit systems from their own resources rose rapidly, particularly in older northeastern cities where transit systems can borrow and also receive state aid. The sharp rise for these cities indicates strong demand for capital in areas other than those to which appropriations had been allocated, or for project types other than those eligible for aid.

7. General Accounting Office, "Budget Issues, Analysis of Unexpected Balances at Selected Civil Agencies," GAO/AFMD-86-76BR (September 1986). GAO data are at current price levels.

Had earmarking of both eligible recipients and eligible projects been avoided so that appropriations could have been applied to other ongoing capital improvements, the unobligated balances could have been used up. Doing so would have maintained the high ratio of federal grants in overall net additions to transit capital. On the other hand, since increasingly large amounts of nonfederal financing have been available for these other projects since 1981, the expansion of federal capital grants for transit in 1982 seems simply to have provided inflexible and excessive aid (see Figure 9).

FIGURE 9. RESOURCES AVAILABLE FOR TRANSIT INVESTMENT
(In billions of dollars at 1982 prices)



SOURCE: Congressional Budget Office, from budget data.

NOTE: Net investment is based on equal annual deductions for depreciation.

Credit Subsidies for Physical Investment

Credit subsidies for physical investment have fallen from around \$15 billion a year (at 1982 prices) in the late 1970s to \$6 billion or less annually during much of the 1980s. Estimates for 1987 show subsidies at around \$4.5 billion. Reductions in this form of federal support for investment have occurred in both subsidized direct lending and in federal loan guarantees. Subsidized lending for physical capital is now less than 40 percent of all federal credit subsidies.

Current credit subsidies for physical capital favor small business development and rural electrification projects; the guarantees are mostly for housing investment. Direct loan subsidies in the late 1970s also provided substantial support for rural and low-cost housing, while support for housing investment through federal guarantees was much higher than now. Subsidy reductions have been achieved both by reducing authorization for lending (sometimes partly offset by other forms of subsidy, such as housing vouchers), and by stiffening loan terms or increasing guarantee fees--thus reducing not only the subsidy rates on loans but also the demand for subsidized lending.

Implications for National Saving and Investment Data

Including federal subsidies for fixed capital investment in national saving and investment data raises the same issue as including direct federal investment: budget accounts can be fairly simply split into capital and current spending, but it is questionable whether the net public investment is a clear addition to national investment, is partly included in private totals, or is overstated because of low financial returns. A second issue is that although much state and local investment is financed from the federal budget, that part financed from grants would conventionally be treated as a subset of state and local, rather than federal, investment. Similarly, the increased public saving that resulted would be measured as part of state and local government saving, rather than as a reduction of the federal deficit. No adjustment would be made for credit subsidies for physical investment, since they are already properly included in private saving and investment data.

Basing the adjustments on the most generous measure of net investment from federal grants (deducting depreciation only when assets are withdrawn from service) would raise public saving (by increasing the combined surplus of state and local governments) by 0.7 percent of net national product. This percentage is nearly half of the overall 1.3 percentage points added to the national saving rate by recognizing state and local government physical investments. Using straight-line depreciation would add only 0.3 points to the saving rate from grants, with an overall addition from all state and local net investment of 0.6 percent of NNP. In this second measure, additions from grants exceeded overall additions for much of the past 10 years because of the negative local own-source investment discussed earlier. Patterns in investment and saving rates under these assumptions are shown in Figure 10.

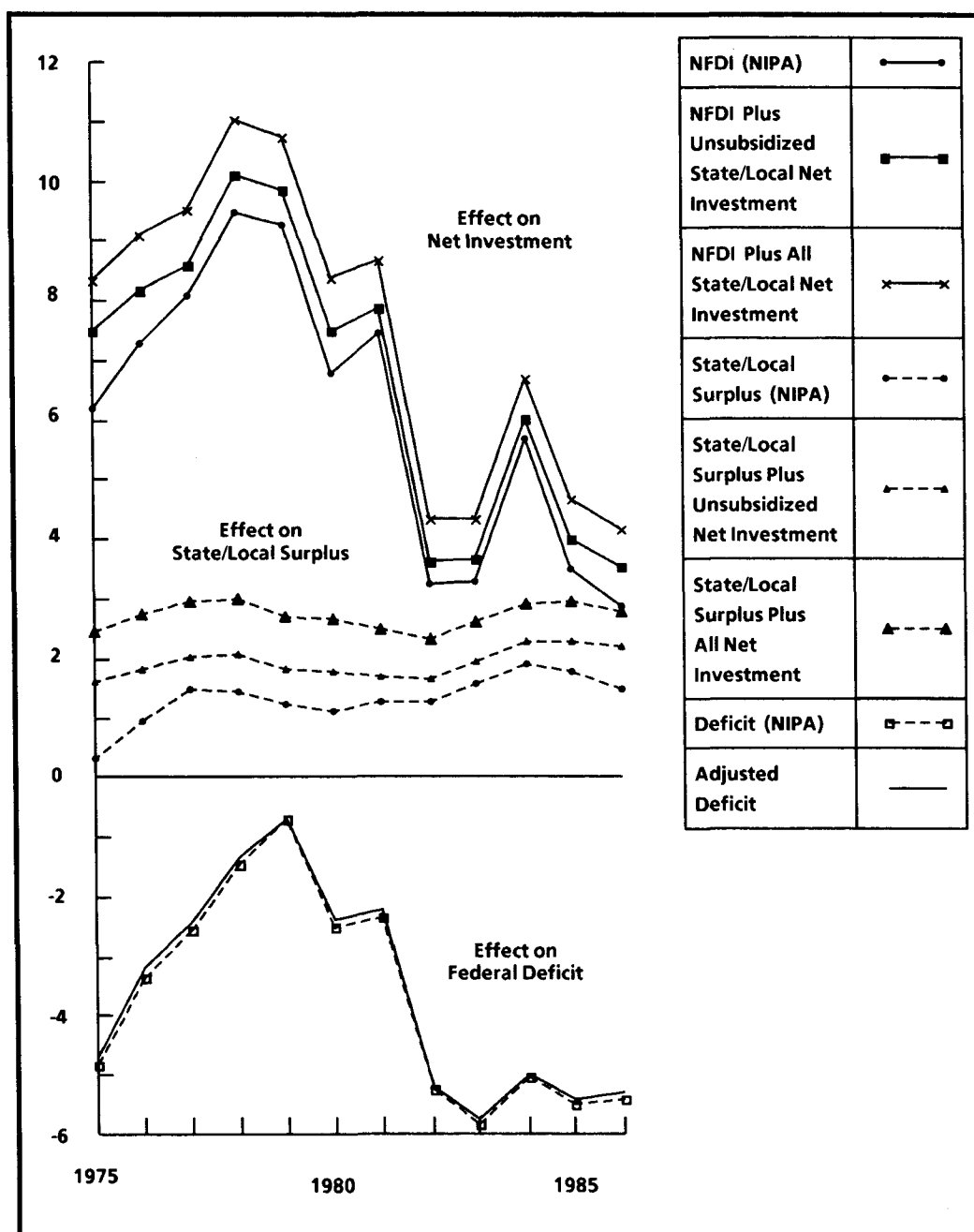
SUBSIDIES FOR INVESTMENT IN HUMAN CAPITAL

Including investment in human capital in national totals would acknowledge the contribution made by the skills and other developed qualities of the work force. Current accounting treats these skills and qualities as freely provided, and may thus obscure the importance of human development vis-a-vis physical investment.

Although the concept of human capital is clear, it is difficult to say where investment in it ends. Researchers have identified training, knowledge, and skill as important components of human capital.^{8/} Spending for education has received substantial attention in studies of growth and productivity. Theoretical cases can be made for including expenditures on health and mobility in such investment, and at least

8. The concept of human capital as a complement to physical capital in production has been in occasional use since the mid-1930s, but development of the concept and a measurement system for it is generally attributed to the work of Schultz and Becker in the early 1960s. See Theodore W. Schultz, "Investment in Human Capital," *American Economic Review*, vol. 51 (March 1961), and Gary Becker, "Investment in Human Capital: A Theoretical Analysis," *Journal of Political Economy*, vol. 70 (Supplement: October 1962).

FIGURE 10. EFFECT OF FEDERAL, STATE, AND LOCAL PHYSICAL INVESTMENT ON NATIONAL SAVING AND INVESTMENT RATES (As a percent of NNP)



SOURCE: Congressional Budget Office, based on data from the Bureau of Economic Analysis.

NOTE: Net investment is based on deducting discards from capital stocks from gross investment.
NFDI = Net fixed domestically owned investment.

one major study has widened the field even farther.^{9/} But if the scope of investment activity in human capital is widened to include activities that provide non-income benefits to future generations (similar to investment in defense assets, for example), then practically all spending on social welfare functions could be counted as investment.

Equally important is the lack of a clear standard in this area for defining annual capital consumption, with the attendant difficulties of distinguishing between investment and consumption elements in human development. Unemployment insurance, for example, has been classed with investment activity in at least one study, because it improves employers' abilities to hire and fire (and thus raises profits) by providing a cushion for workers moving from job to job. Logically, however, it should be counted as current consumption rather than investment spending. The asset would be the pool of unemployed workers just necessary to maintain (some desirable level of) work force mobility; the investment would be the spending on training for eventually unemployed workers, and the capital consumption would be the unemployment compensation payable to the pool.

More broadly, health care invokes the same concept of human capital as does education. A healthy, well-trained work force could be regarded as a national asset created by expenditures on health care and education. But despite this theoretical argument, it is difficult to fit health care into the human capital framework. Society provides health care on bases other than productivity, while education beyond a basic level is often available only competitively. Moreover, federal health programs have a large constituency among the elderly, who now receive about one-quarter of the benefits. Taken altogether, education probably has a larger investment component (that is, spending directed at increasing income) than health. Also, earnings and attainments--the primary indicators of human capital--are much more easily distinguished by occupation or skill levels than by health

9. Concepts of human capital dating from the 1930s argue that workers' skills cannot reasonably be separated from the workers themselves, and that all activity leading to long-term changes in people should be called investment. Under this argument, child-rearing and nutrition programs would be included with human capital formation. See Irving Fisher, *The Nature of Capital and Income* (New York: Macmillan, 1930). This concept is applied in John W. Kendrick, *The Formation and Stocks of Total Capital* (New York: National Bureau of Economic Research, 1976).

ratings. Finally, health expenditures may be inversely related to healthiness; more often than in education, perhaps, large expenditures for medical care may produce only small changes in health status. Thus it is difficult to find a satisfactory basis for measuring investment in human capital through medical care.

Measuring Investment in Human Capital

For reasons spelled out in Chapter III, no data series is presented on federal investment in human capital. Rather, because of the speculative nature of such data--what should be included and excluded, how noninvestment components of spending for human development should be treated, and how capital consumption may be estimated--only broad indicators of federal assistance in relevant fields can be presented. Moreover, since federal programs in human capital areas, like grants to states and localities, mostly provide subsidies that finance investment by others, the broad thrust of the discussion examines how national trends in saving and investment would change if the concept of human capital development were included in official data on saving and investment.

According to NIPA data, federal spending for education and training services (that is, other than capital construction, research and development, or capital grants for these functions) rose from around \$23 billion in 1975 to a peak of around \$25 billion in 1980 and has since fallen again to \$17 billion (in 1982 dollars). To this spending may be added estimates for the value of loan subsidies for education under federal programs. This study estimates that these subsidies have increased from around \$750 million in the late 1970s to around \$2.9 billion in 1986. Altogether, these data put resources for education services under federal programs at around \$20 billion now. In contrast, comparable national spending, including costs of public education to states and localities and amounts spent for private schools by families, has risen fairly steadily from just over \$170 billion to around \$190 billion (NIPA basis, also in 1982 dollars). None of these measures makes allowance for the share of the expenditures that could be considered consumption rather than investment, or for the share going to capital consumption, and thus they only roughly correspond with, but probably overstate, investment in human capital as measured in other studies. Unlike other investment extensions discussed previously, the

federal share in these investmentlike activities is relatively small (less than one-eighth) and declining.

Most of the fall in the federal share has been borne by cuts in student assistance and in training assistance (which the national accounts identify as transfer payments to individuals for education, and training grants-in-aid to states and localities, respectively). Together spending on these programs has fallen by 40 percent (after price adjustments) since 1980. This decline, together with the increase in subsidized lending for higher education, has tended to switch assistance to students at colleges and universities from grants to loans. Whereas loan subsidies were 22 percent of federal student assistance in 1980, their share was up to 38 percent in 1986.¹⁰ Education grants-in-aid to states and localities (other than for capital projects) also fell by about one-third (after price adjustments) between 1980 and 1983, but has since recovered to around \$7 billion (in 1982 prices) or about three-quarters of the 1980 level. Grants-in-aid for training are much lower than in earlier years and are now around \$2.9 billion (in 1982 prices). Overall, the effect of these changes has been to lower the share of grants-in-aid in overall federal assistance from about 58 percent in 1980 to 45 percent.

Direct federal spending for education and training is minor and mostly consists of providing education or training for federal employees. Were these expenses to be capitalized, net investment for this purpose might now be negative. Although spending for federal agency in-house training has approximately doubled since 1970, and now runs at around \$1 billion a year, adjusting it for the turnover of trained employees indicates that it may not be sufficient to offset increases in labor costs and the estimated loss of skills through retirement or other turnover. To the extent that federal employees use skills learned in federal training programs in other jobs after retirement, however, national investment may remain positive.

The relatively smaller role of grants-in-aid in education tends to shift the balance of federal assistance away from the basic skills that

10. Federal student assistance is taken from NIPA data for federal payments to individuals (\$4.8 billion, including veterans' education benefits in 1986), plus \$2.9 billion in loan subsidies. Both figures are in 1982 prices as measured by the implicit price deflator for education expenditures.

grants-in-aid finance. This shift may have lowered the national value of federal education assistance. No direct measures of the value of investment through federal education programs exist, but worldwide studies of education concur that its income-enhancing results are highest for basic or primary schooling, and follow a diminishing trend for secondary and higher levels.^{11/} Federal education grants-in-aid to the states and localities are primarily targeted to basic skills--migrant English, literacy among disadvantaged students, and so on--that would, according to this view, provide the highest returns.

Effect on Saving and Investment Rates

The NIPA measures of education and training spending are sizable and would, if included as national investments, significantly alter measures of national investment. Federal spending of around \$20 billion represents, like other extended investment concepts, only a small share--about 0.7 percent--of net national product. Overall national spending, however, is around 6 percent of NNP, and if included would raise the national investment rate to about 9 percent, through additions to household investment.

Including expenditures on education and training as human capital investment would, however, add great uncertainties to national data on capital formation. First, the estimates above use spending data unadjusted either for noninvestment aspects of

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11. Returns to education investment are usually measured from the point of view of students, by comparing costs of education (including, where relevant, costs of income delayed by schooling) and additional earnings of graduates (over those of workers with lower qualifications) at each level. But the lack of an identifiable control group of illiterate adults in the developed countries prevents one from directly estimating the benefits of education in basic skills in those countries. Moreover, some researchers question whether education attainments adequately reflect levels of skill that influence earnings, and others argue that results based on individual returns are less informative than analyses of aggregate changes in education or skill levels. Private rate-of-return measures reflect only costs and benefits to students. Corresponding estimates of social returns correct for subsidies that reduce private education expenditures. All estimates are usually corrected for the effects of experience gained after graduation. The estimates therefore reflect average returns to students completing different levels of school. They can be taken as approximations for marginal returns to education programs to the extent that they show what an additional student could expect to earn from educational investment (or what a student could expect to earn from additional education).

education and training activities or for capital consumption. In official data, and in all the other investment categories discussed in this paper, net investment after such adjustments is the usual measure. But in the area of human capital, such adjustments must be wholly speculative. Second, limiting human capital investment to education and training is itself arbitrary. As discussed earlier, many researchers have used a much broader coverage of income-enhancing human capital activities, and some have even argued that measures of human capital should extend beyond income-earning qualities to general measures of human development. Thus, unlike the "long-lived income-earning plant and equipment" concept of physical capital, the idea of human capital has no generally accepted bounds.

OVERALL EFFECTS OF EXTENDING CAPITAL CONCEPTS ON NATIONAL SAVING AND INVESTMENT RATES

In Chapter IV it was shown that adding federal physical investment to the official national investment data would increase net domestic fixed investment by \$4 billion a year or less, and would raise national capital formation by as little as 0.1 percent of net national product. The size of the increment fluctuates somewhat, but has remained at around this level for the last decade. Thus, recalculating national saving and investment data to include federal physical investment that is similar to the investment of households or firms would not significantly change the trend or level of the official data, nor the conclusion that capital formation rates have fallen steeply during the 1980s.

The extensions discussed in this chapter extrapolate the implied NIPA characterization of investment to other investmentlike activities, and would, if adopted, also change some measures of private investment. In the federal sector, the adjustments would all generally be larger than that implied by the NIPA-based physical capital adjustment, but would still be less than 1 percent of net national product (typically, 0.6 percent to 0.7 percent). Despite fairly large increases in purchases of weapons systems (raising net investment in defense assets) and in military research and development programs (raising net investment in intellectual capital), none of the extended concepts would make a large change in official data, and together

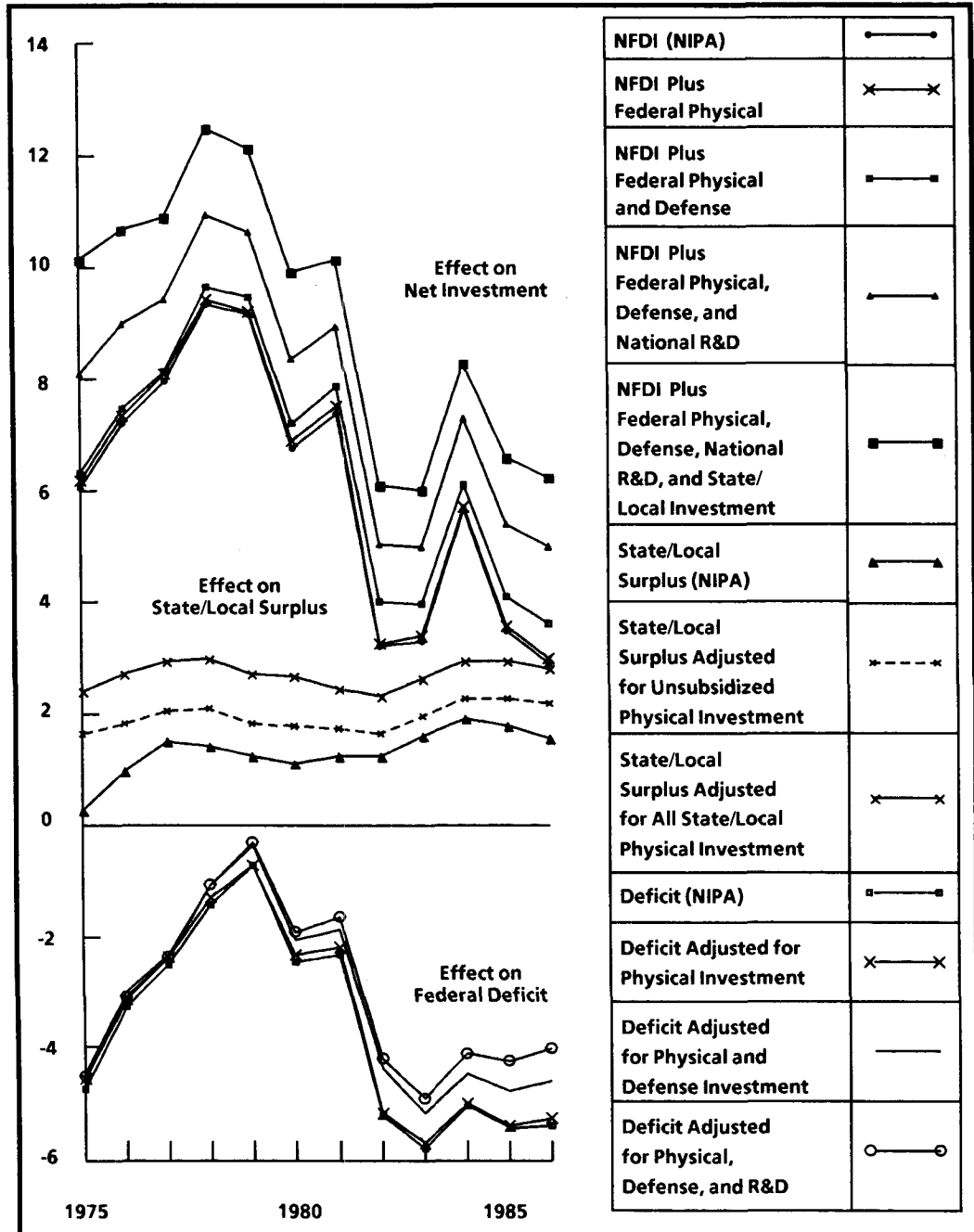
these concepts do not suffice to offset the fall in national investment during the 1980s. Figure 11 illustrates these overall effects.

Overall, using the more generous measure of net public investment in each category, the adjustments in Figure 11 would have added just under two percentage points to net domestically owned fixed investment as a percent of NNP in the late 1970s and just over two percentage points in the mid-1980s. Thus, the rate of public investment has changed very little, and not sufficiently to offset falling private investment rates. The increase in public saving associated with the extended concepts would be split between federal (about 1.2 percent of NNP) and state and local governments (about 1.3 percent of NNP), amounting altogether to just over three-quarters of the increased net investment. After adjusting for net investment in physical civilian and defense assets and in research and development, federal deficits would remain at around 4 percent of net national product, and state and local surpluses (because of the physical investment they undertake) would increase to about 3 percent of NNP.

The adjustments would also raise measures of private saving by about 0.7 percent of NNP, because of spending on privately financed research and development that would, under the new concepts, be treated as investment. Much larger increases in private saving could probably be recorded if it were feasible to account accurately and consistently for net investment in human capital. Expenditures on national education and training, for example, at around \$200 billion, are nearly 6 percent of NNP, and around one-third of gross private saving. Thus, even with sizable adjustments for noninvestment elements in these activities and for capital consumption, the effects of including some measures of human capital formation in national saving and investment data might remain large.

In all cases, however, the extension of capital concepts to government budgets would add considerable uncertainty to official data on national saving and investment. Measures of net federal investment in physical assets similar to those for business and household investment may, under alternative assumptions about the appropriate treatment of depreciation, vary by up to one-third of annual spending. Moreover, information on the quality of the in-

FIGURE 11. OVERALL EFFECTS OF DIFFERENT CAPITAL CONCEPTS ON NATIONAL NET INVESTMENT AND PUBLIC SAVING (NIPA basis, as a percent of NNP)



SOURCE: Congressional Budget Office, based on data from the Bureau of Economic Analysis and the National Science Foundation.

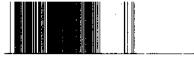
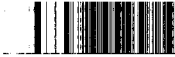
NOTE: Net investment is based on the larger measure derived in each category. NFDI = Net fixed domestically owned investment.

investments and their contributions to increasing national income is patchy; and it is not clear to what extent federal investments are designed to achieve broader social goals not reflected in national income data. In all of the other concepts, while the claim that spending adds to future output (and therefore should be considered as investment) can be fairly easily understood in principle, no way of measuring the effects is available. Defense assets may produce deterrence benefits, but these benefits are not measured in national income statistics; research and development assists industrial and commercial innovation, but there is no consensus about the links between spending, R&D activity, and future payoffs; and federal subsidies for capital purposes in the form of credits and grants have been found to add little to national investment totals. Moreover, determining which types of activity to include in these concepts, and whether and how to represent capital consumption, involves speculation or at best informed judgment, since there are no clear or verifiable measured links between investment and income.



APPENDIXES





APPENDIX A

ASSUMPTIONS ABOUT SERVICE LIVES AND RETIREMENT PATTERNS FOR GOVERNMENT PHYSICAL CAPITAL

Estimates for depreciation and retirement of government assets used to derive figures on net physical government investment in Chapter IV and Chapter V are based on assumptions about asset service lives and retirement patterns shown in this appendix. Table A-1 shows the assumptions about average service lives for government-owned equipment and structures. Average service lives for equipment are assumed to range between 10 years and 30 years, depending on the type of equipment. Government structures are assumed to remain in use for an average of between 32 years and 80 years, with the majority averaging 50 years or 60 years in service.

Table A-2 shows estimated retirement patterns for government assets. Retirement patterns, which describe the variations in the average service lives, are modified from retirement patterns for industrial property. According to these variations, some nonresidential assets are assumed to be retired from use in something under half the average service life, while others remain in use for more than 50 percent longer than the average life. Retirement of residential assets begins almost as soon as some assets are put in service, but others remain in use until almost twice the average service life.

TABLE A-1. BUREAU OF ECONOMIC ANALYSIS ASSUMPTIONS
ABOUT SERVICE LIVES FOR GOVERNMENT-OWNED
PHYSICAL CAPITAL

	Life (Years)
Nonresidential Equipment	
Federal	
Military <u>a/</u>	
Aircraft	12
Missiles	10
Ships	30
Electronic equipment	14
Vehicles	20
Other equipment, including weapons	10
Nonmilitary	
Government-owned, privately operated <u>a/</u>	
Department of Energy	25
Department of Defense	19
Maritime Administration	30
National Aeronautics and Space Administration	15
Enterprises <u>a/</u>	
Power-related <u>b/</u>	25
Other <u>c/</u>	15
Other	
Industrial plant equipment <u>a/</u>	19
All other	15
State and local (including enterprises)	15
Nonresidential Structures	
Federal	
Military <u>d/</u>	50
Nonmilitary	
Government-owned, privately operated <u>a/</u>	32
Enterprises <u>a/</u>	
U.S. Postal Service, Commodity Credit Corporation	50
All other	60

(Continued)